scarcely any information respecting the scientific principles of the art, and even Faraday's great law of definite electro-chemical action is not mentioned or explained. It will therefore be more readily purchased by the ordinary than by the superior workman, by those who prefer to work by "rule of thumb" than by those who wish to be guided by the light of science.

With regard to the statement on p. 1, that "the art of electro-metallurgy cannot be said to own an inventor," it is true that the complete art is not due to a single inventor, but it owns a series of inventors, viz. Wollaston (1801), Brugnatelli (1805), De la Rue (1836), Jacobi, Jordan, Spencer (1839), J. Wright (1840), J. Elkington (1865), &c., who were all of them prominent inventors of electro-metallurgical methods.

The rules given on p. 4 for selecting a suitable depositing solution are good, and are well known; and the remark on p. 7, that "the main consideration must be directed to current density," is a widely applicable and very useful one.

The statement on p. 8, that the current deposits the metals from solutions of alloys "in proportions determined rather by their electric equivalents than by the quantity of the metal in solution," is a very doubtful one; for instance, with copper and zinc in solution together, the electro-chemical (not "electric") equivalents of which are about equal, if the copper is in large proportion compared with the zinc, copper is deposited, and no zinc is usually deposited along with it, unless the current is of great density at the cathode.

The idea expressed on p. 12, that "the internal resistance of a battery may be reduced by using longer connecting wires between the cells," is not in accordance with the established conventional understanding that "internal resistance" is limited to the contents of the battery cells. The information given about the arrangement and construction of several kinds of voltaic batteries is full and explicit, and the same may be said about arranging their cells in series and in parallel.

With regard to the chapter on dynamos, it is a very useful one, and the longest in the book; and the construction and action of those machines are as fully described as any other part of the subject; but, whilst several good dynamos for electro-plating are mentioned and illustrated, some obsolete and wasteful ones are figured and described which might have been omitted.

Chapter vi., "Electro-plating with Silver," contains much information, both of general matters and of details useful to the working electro-plater; the statement, however, on p. 125, that the foreign salts which usually exist in a dissolved state in a cyanide of silver plating liquid "offer a resistance to the current," has never yet been demonstrated; in fact, they rather tend to diminish the resistance, and it is only when they give rise to a solid film upon the anode, and that is very rarely, when the liquid is deficient in free cyanide of potassium, that they obstruct the current.

The statement on p. 165, in the chapter on "Nickel-plating," that "very little was effected in a practical way until 1890, when Mr. Adams discovered that nickel could be deposited from a solution of the double sulphate of nickel and ammonia in a reguline condition," requires a little qualification, for both previous to and at that period the double chloride of nickel and ammonium (generally known as "Gore's solution") was rapidly extending in use in America, the early home of nickel-plating.

The chapter on "Electro-plating with Copper," is very brief. Whilst the one on "Dynamos" occupies 38 pages, and might in some respects have been abbreviated with advantage, that on "Copper" fills only 7 pages, and might have been extended.

A rather serious error in the chemistry of the subject occurs on p. 200, where the table, and the column of numbers which are really the atomic weights, are each headed "combining weights"; and the electro-chemical equivalents are headed "electric equivalents." Now, the atomic weights are in many cases very different from the combining weights, and the numbers which are there termed "electric equivalents" should have been called "electro-chemical equivalents."

Instead of employing the simple terms, made, making, stirring, &c., the author, throughout the book, continually uses the phraseology, "made up," "making up," "stirring up," "faking up" the solutions, batteries, apparatus, &c. These, however, are minor matters. The chief defect in the book is that "it supposes the workman to have an elementary acquaintance with electrical science," and, apparently on the basis of that usually fallacious assumption, omits nearly all information respecting the fundamental principles of the subject. Now we know that not only the working man, but the sons of persons in much higher grades of society, are often so incompetent to appreciate the great value to themselves of knowledge of important principles, and so anxious to obtain "quick returns" in the form of money or some easily perceived personal advantage, that they are apt to shirk learning anything which they think will not quickly yield them a profit, and this radical defect should not be encouraged by those who undertake to teach. An omission of all reference to the principles of his subject further indicates that the teacher himself either does not fully understand or adequately appreciate the foundation of the matter he professes to teach. Knowledge of the principles of his occupation is usually the point in which the workman is most deficient and most requires to be instructed.

Notwithstanding this drawback, the book is sound and good in nearly all matters of practical detail; it is also well illustrated, and may be used with advantage as supplementary to a more scientific one containing the principles of electro-metallurgy.

OUR BOOK SHELF.

Primitive Folk: Studies in Comparative Ethnology. By Élie Reclus. (London: Walter Scott, 1891.)

THIS volume belongs to the "Contemporary Science Series," edited by Mr. Havelock Ellis. It contains a popular account of the Eastern and Western Inoits, the Apaches, the Naïrs, the mountaineers of the Neilgherries, and the Kolarians of Bengal. The writer does not group his facts in accordance with any controlling idea, so that the book can hardly be said to have much continuity of interest. He writes, however, in a fresh and lively style, and has brought together many curious facts; and the work may serve as an attractive and useful introduction to the study of some aspects of ethnography. He has, of course, to describe many customs and modes of thought

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which, if judged from our point of view, would produce a strange impression; but these he puts in their right place as elements which mark definite stages of evolution. Too few references are given in the notes, but the information may be accepted as generally trustworthy, having been for the most part derived from the statements of travellers and missionaries during the first half of the present century.

Tongues in Trees and Sermons in Stones. By the Rev. W. Tuckwell. (London: George Allen, 1891.)

The greater part of this volume is occupied with papers which bear the general heading "Tongues in Trees." They are interesting essays, written in a clear and pleasant style, and presenting in a fresh light a good many "facts in flower-lore" Among the subjects are tree worship, tree myths and superstitions, plant-names of persons, places, and seasons, plant monsters, gardens, and plant literature. The fact that there may be "sermons in stones" is illustrated by a short paper on sundials, reprinted from the *Gardener's Chronicle.*

Supplement to Euclid Revised. By R. C. J. Nixon, M.A. (Oxford: Clarendon Press, 1891.)

In this little book the author has placed before the student a few theorems on the more modern geometry of the triangle. The points touched upon relate to the Lemoine and Brocard points, lines, and circles; and a study of these will serve as a good introduction to many of the more advanced theorems. The proofs are concise and complete, and a few exercises are added which are more or less dependent on them.

LETTERS TO THE EDITOR.

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The Alpine Flora.

For some years past we have endeavoured to make as large a collection as possible of the more interesting Alpine plants at Kew. And I am glad to take the opportunity of acknowledging the invaluable assistance which we have received from Mr. G. C. Churchill, who has spared no pains on our behalf in corresponding with collectors in almost every mountainous district of Europe.

The observation of the Kew collection has led me to a few conclusions which have some bearing on the questions raised by Mr. Cockerell and the Rev. George Henslow.

What are called Alpine plants appear to me to fall into two distinct classes: (1) those which have a permanent adaptive habit, and (2) those which have a habit due merely to the local conditions of the growth of the individual plant and not maintained by it if those conditions are altered.

The peculiarities of the former class I am disposed myself to attribute to natural selection. Anyone who supposed that Alpine plants were particularly "hardy," would find himself very rapidly disabused by attempting to cultivate them. I have no definite data on the subject; but I am inclined to think that for the most part they are intolerant of very low temperatures. They certainly are extremely impatient of humidity during the period—a comparatively long one—when they are not in active growth. We are for these reasons, paradoxical as it may seem, obliged at Kew to winter our large collection in frames under glass. The reason is that in Nature, except for a short time, Alpine plants are covered with snow, which keeps them dry and protects them from a very low temperature. Last summer, accompanied by the foreman of our herbaceous department, Mr. Dewar, I crossed the Zwischbergen Pass from the village of Simplon to Saas. This was late in July, and on the south side we crossed a wonderful area of Alpine vegetation from which the snow had only just melted; I suppose that by the end of September it would be covered up again. I presume the ground would remain permanently frozen at no great depth. The plants were therefore reduced to growing in the thin film of soil warmed during exposure by the sun's heat, and this would be, for the greater part of the year, sandwiched between deep overlying snow and the frozen subsoil. No plants which had other than a close dwarf habit would seem to me to have a chance of existing under such circumstances.

On the lower slopes of the valleys of the Alps there is a profusion of interesting plants, which, though not so dwarf as those of higher levels, still derive a good deal of their charm from the more or less compactness of their growth. It is a matter of general experience that, when many of these are transferred to a country such as England, they develop into a coarse weedy habit which deprives them of a great deal of their interest. I am not satisfied that a richer soil in cultivation affords the explanation of this. I am disposed to think that the conditions of solar illumination in the Alps are a much more important factor.

Every practical gardener knows that if you want to maintain a desirable stubby habit in a decorative plant, and to keep the vegetative structures in proper subordination to the flowers, you must expose your plants as freely as possible to sunlight. This is not, however, a question of promoting assimilation, but of preventing elongation and extension of parts already formed. There is probably much the same amount of material in the stubby and the lanky plant.

Now plants which grow at high levels in the Alps are *above* a great screen of aqueous vapour. They therefore get a larger share of the more refrangible rays of sunlight than those that grow nearer sea-level. And it is precisely these rays which it is known inhibit growth or rather extension in length.

But though, as I believe, this restraining and, if you like, dwarfing action has been going on for ages, it is not my experience that the effect is permanently impressed on the species. I wish it were.

I have met with one plant in which I thought that I had got a case of the transmission of an acquired habit. Mr. Churchill procured for us seeds of *Arabis anachoretica*, "a form of *Arabis alpina*, L., with thin tissue-papery leaves, growing in hollows of the rock where neither sun nor rain reach it, just as *Saxifraga arachnoidea*, as also *Heliospermum glutinosum*, and *Zahlbrucknera paradoxa*, all which have very thin tissue-paper leaves." Alas, on cultivation at Kew it reverted forthwith to commonplace *Arabis alpina.*

Mr. Henslow remarks that "the action of the environment on plants is a thing which can be tested," while the accumulation of many useful variations cannot. Hence he appears to infer that Darwinism is an *a priori* theory, while neo-Lamarckism is not. If he rests this conclusion on facts drawn from the study of the Alpine flora, all I can say is, that while horticulturists are obtaining dwarf varieties every day by selection, I am not aware of any one which can be demonstrably shown to be the product of the action of external conditions.

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Royal Gardens, Kew.

Neo-Lamarckism and Darwinism.

Mr. Cockerell's reply to my remarks is interesting, as I cannot find anything in it with which I do not cordially agree. A few words, however, may clear up matters.

(1) I referred only to dwarfs on high Alpine and Arctic regions. *These* are due to cold (see Grisebach, "La Vég. du Globe," i. 49-51; Verlot, "Sur la Production et la Fixation des Variétés," p. 36).

(2) I am quite convinced of the hereditary character of "nanism," as also of "gigantism," as well as of other results of the direct action of the environment on plants; and am glad to find Mr. Cockerell has come to this conclusion from direct observation. As an example of hereditary hypertrophy, the parsnip called "The Student" was raised by Prof. Buckman from seeds of wild plants in 1847, and it is still sold by Messrs. Sutton as their "best variety." On the other hand, Mr. Cockerell is perfectly correct in admitting the, so to say, plasticity of dwarfs. Indeed, my own experiments with aquatic plants lead me to wonder why some species are, as a rule, so fixed as they generally appear to be.

(3) Tall plants are certainly liable to be injured by winds; as I added, "as occurs at lower altitudes"; but are there any such among the dwarfs *above the tree line?* If not, natural

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